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Proposed algorithm for feature extraction of Speech Waves & Facial Images in Biometric system

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Abstract

The paper presents a new user biometric authentication system focusing on a mutual acquisition of facial and language or voice with highly accurate rate, true positive and rejection rate. In Speech acknowledgment the characteristic component are combinations of still and self-motivated structures those have been removed and classified the data through CNN algorithm. Whereas proposed Feature extraction algorithm, used for unique properties identifying, thus obtained is the face database in the knowledge set. After that FAR, FRR and exactness have been assessed in which proposed algorithm performs well. From the diagrams, it has been inferred that Autonomous segment examination and GTCC system functions admirably.

Keywords - WIMAX, CDMA, WLAN, VHO, UMTS, MADM.

I. INTRODUCTION

A large portion of the biometric frameworks will serve one of the two essential purposes: validation/confirmation or distinguishing proof. Validation (or check) is the procedure of emphatically recognizing the client. These are: learning based frameworks, (in view of what you know, for example, watchword, individual recognizable proof number (Stick)); protest based frameworks, (in light of what you have, for example, token, keen card); and physiological/behavioral trademark based frameworks, (in light of your identity, for example, biometrics).

The human face assumes a critical part in our social [3][6] interface, passing on individuals' character. When contrasted with other biometric plans utilizing unique mark/palm print and iris, confront acknowledgment has particular advantages as a result of its non-contact technique. Face pictures can be obtained without touching the individuals being recognized, and the documentation does not even require collaborating with the individuals. Likewise, confront acknowledgment serves the wrongdoing preventive assurance since confronts pictures that have been checked and chronicled can later help recognize a man.

1.1 GTCC (Gamma Tone Cepstral Coefficient) Algorithm

Gamma tone Campestral Co-efficient method is defined that the Gamma tone filter-bank, which efforts to perfect structure the human acoustic system as a sequence of overlying band pass sifters. It is utilized for both boisterous and clean conditions, MFCC and GTCC are comparative acknowledgment in clean condition and GTCC is better in loud condition Like Mel Recurrence Cepstrum Coefficient (MFCC), there is another component vector called Gamma tone Cestrum Coefficient (GTCC) or Gamma tone [5] Recurrence Cestrum Coefficient (GFCC). An important

finding in the study is that GTCC characteristics result conservative MFCC characteristics below deafening situations. Broadly speaking, there are two major differences between MFCC and GTCC. The obvious one is the frequency scale. Thus GTCC provides more accurate results than MFCC [5]. The figure below gives the GTCC processing flow diagram. The main features are highlighted below.

- Use filter banks to band pass the speech signal
- Estimate short average windowing range.
- Estimate the Cepstrum coefficients.
- Truncate the Cepstrum coefficients.

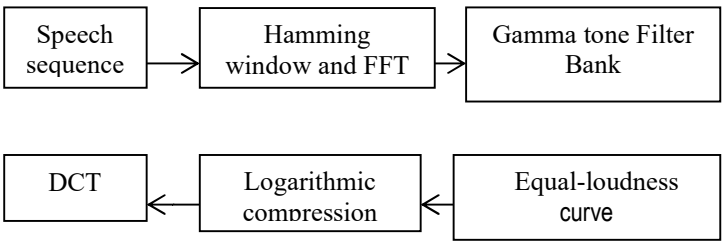


Fig.1.1 GTCC Processing

The multi modal biometric system is the science and innovation utilized for measuring, breaking down the natural information. The biometric is utilized for removing a list of capabilities from the procured data, and contrasting this set close by with the format set in the database. Biometric combination can be characterized as the utilization of various sorts of biometric information for enhancing the execution of biometric frameworks. An immaculate biometric ought to be single, all-inclusive, and changeless above time that is anything but difficult to gauge additionally modest in costs, and have high client acknowledgment. No single biometric can satisfy every one of these necessities all the while. For example, fingerprints and retina are known to be very selective, yet they require devoted sensors and are not easy to understand. Then again, voice and facial geometry are not as elite, but rather they require just a shabby receiver or a camera as a sensor, and they are unpretentious. Along these lines, the mix of a few integral biometrics can give higher acknowledgment exact than any individual biometric alone. Multimodal biometric frameworks perform superior to uni-modular biometric frameworks as it evacuates the constraints of the single biometric framework. The fundamentally preferred recognition used in criminology is private classification. [2][4].

II. BIOMETRIC SYSTEMS

Normally, some biometric system authentication includes the subsequent units:

- *Information Acquisition:* It consists of obtaining the biomedical signals with the aid of some specialized form of transducers and later conversion of these to digital format. [1].
- *Feature extraction unit:* The drawing out of specialized features is performed by the use of any classifiers like SVM, Neural network, HMM and feature extraction methods like GA, PCA, and ICA etc.
- *Matching unit:* harmonizing of testing samples is performed by the use of distances like hamming, Euclidean distances.

- *Final Decision Making*: In this the main task to be performed is a binary judgment whether to receive or reject the demanded identity [5].

1.3 Multi-Model Biometric System

The multi-modal biometric indicators for verifying particular is known as multi-modal biometrics. There are many levels at which fusion takes place like extraction level, matching the score level, sensor level and decision level [6][7].

1.4 Architecture of Multimodal System

The structure of a multi-modal biometric structure mentions to the order in which the various models are attained and administered.

Types of Architecture:

1) Sequential
2) Similar

1) Sequential Structure: In this architecture, processing takes place in the sequential manner. E.g. ATM processing [11].

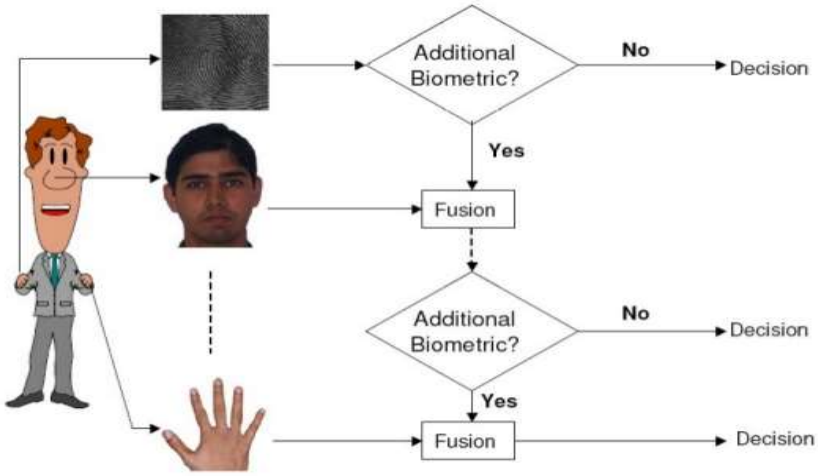


Fig 2.1 (i): Serial Architecture

2) Parallel Architecture: In parallel architecture, processing takes place in the non-sequential manner. e.g. military.

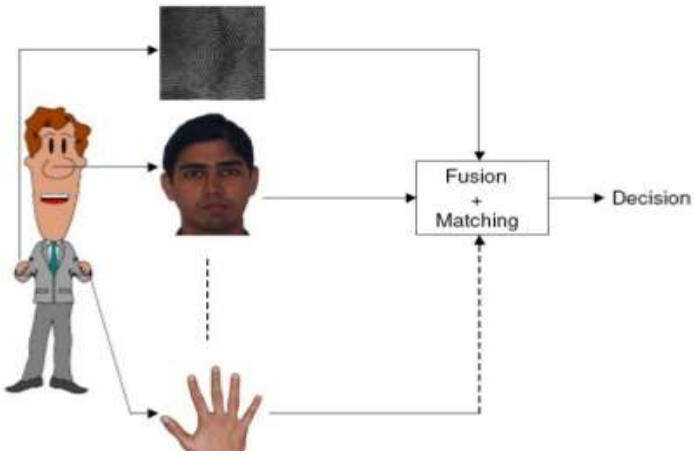


Fig 2.2 (ii): Parallel Architecture

A large portion of the biometric frameworks [8][9] will serve one of the two essential purposes: validation/confirmation or distinguishing proof. Validation (or check) is the procedure of emphatically recognizing the client. ID, then again, is the strategy of recognizing a different from a bigger arrangement of individual records by contrasting the introduced biometric information and all passages in the framework database. These are: learning based frameworks, (in view of what you know, for example, watchword, individual recognizable proof number (Stick)); protest based frameworks, (in light of what you have, for example, token, keen card); and physiological/behavioral trademark based frameworks, (in light of your identity, for example, biometrics). Actually, the informal community of the client, that is, some individual you know, as of late proposed as the fourth factor that can be utilized for validation. The figure 2.1 & 2.2 above shows the architecture of multimodal system.

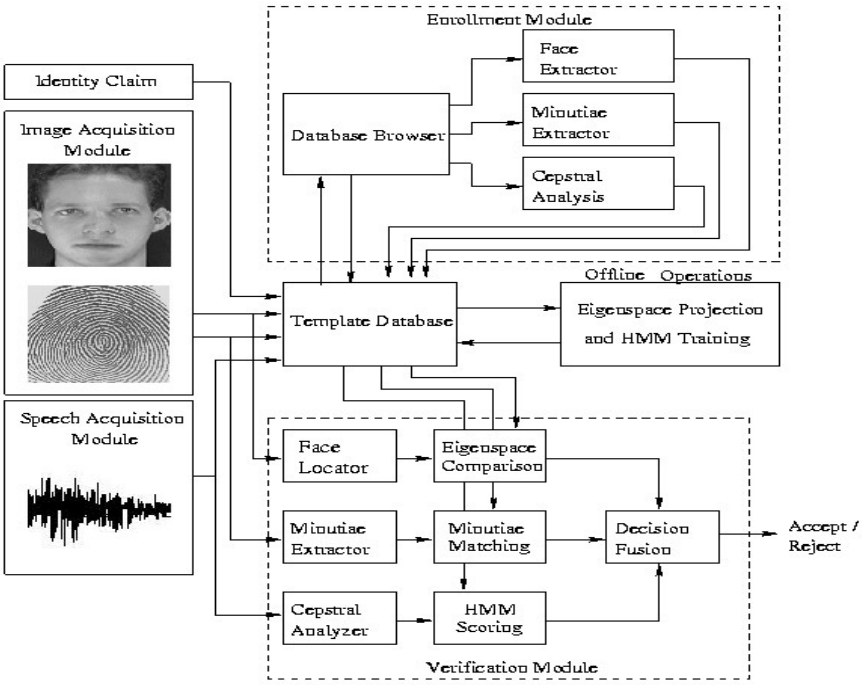


Fig 2.3: Multimodal Biometric System

There are several limitations that are overcome by the multimodal biometric systems. But the multimodal biometric authentication systems are extra expensive than the uni-modal authentication systems.

Multi-modal biometrics system is the arrangement of double or further modalities like, iris, face, speech and ear modalities. The figure 2.3 illustrates the model of multimodal biometric system. In this model a face recognition system and speech [31] ID system is collective as these functions are worldwide conventional and expected to harvest.

Now a day a key problem is that to what grade structures are to be removed and how the cost aspect can be reduced, as the quantity of structures upsurges the inconsistency of the intra particular illustrations due to bigger delay in between repeated acquirements of the illustration.

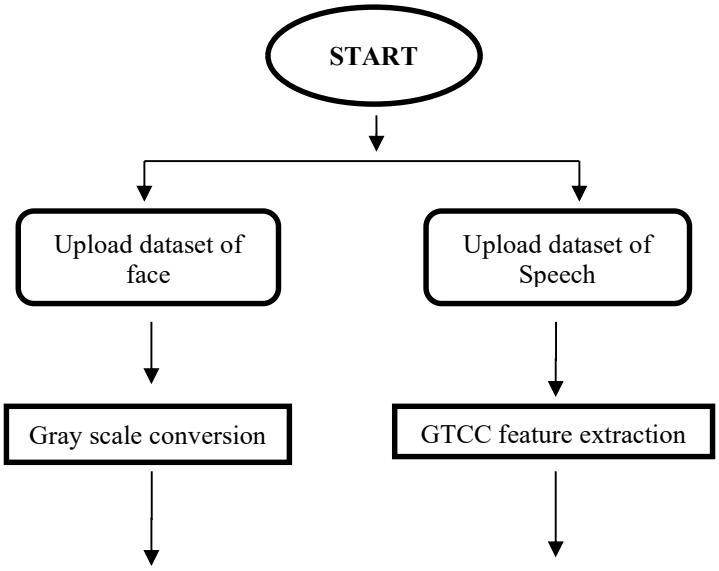
III. METHODOLOGY

The proposed model, the major aim is to present the recital of the interactive multi-modal biometric authentication system based-on user reliant on weighted synthesis approach.
The enrollment stage, facial features and speech features have developed an initial and then administered, allowing to the knowledge based data training and feature extraction methods.
In facial detect or recognize, feature vector of the iris knowledge based data is resultant from component features and classified technique are used. The feature vector is the speech model in the knowledge base.
In Speech acknowledgment, the characteristic component is the combinations of still and self-motivated structures those have been classified through CNN algorithm.
Feature extraction algorithm used for unique properties identifying, thus obtained is the face database in the knowledge set. In the verification phase, the similar score of the test framework and the training structure are consequent.

i) ICA (Independent Component Analysis) Algorithm

ICA is a prominent among the most generally utilized BSS for separating singular signs from blends. Its energy exists in the physical suppositions that the distinctive physical procedures create inconsequential signs. The straightforward and non specific nature of this supposition grants ICA to be effectively connected in different assortment of research fields. In ICA the general thought is to isolate the signs, accepting that the first basic source signals are similarly freely focused. Because of the field's moderately youthful age, the qualification amongst BSS and ICA is not completely clear. While with respect to ICA, the fundamental system for most extreme scientists has been to accept that the blending is prompt and straight, as in casual. ICA is frequently portrayed as an expansion to PCA, which uncorrelated the signs for higher request minutes and produces a non-orthogonal premise [20].

The Quality measurements are a measure of execution of the techniques used to build up the FER framework. So these above quality measurements are utilized as a part of this exposition to discover the consequences of all the Outward appearance acknowledgment strategies utilized. We compare the result of all FER methods in terms of their values of image metrics which is obtained after applying the operations for individual method.



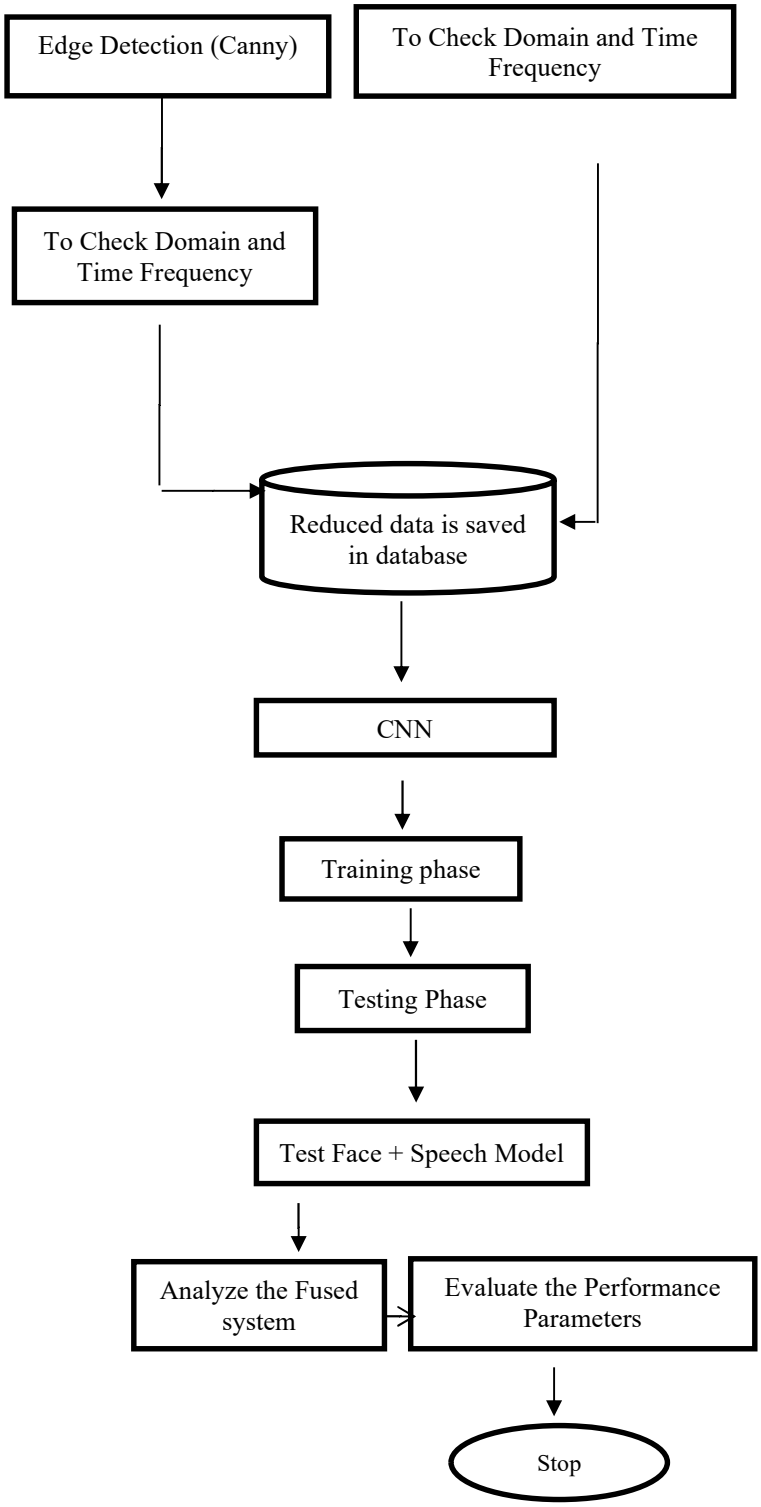


Fig 3.1: Proposed Flow chart

IV. OBTAINED RESULT

In this Section, we have highlightd the obtained results according to the cases:

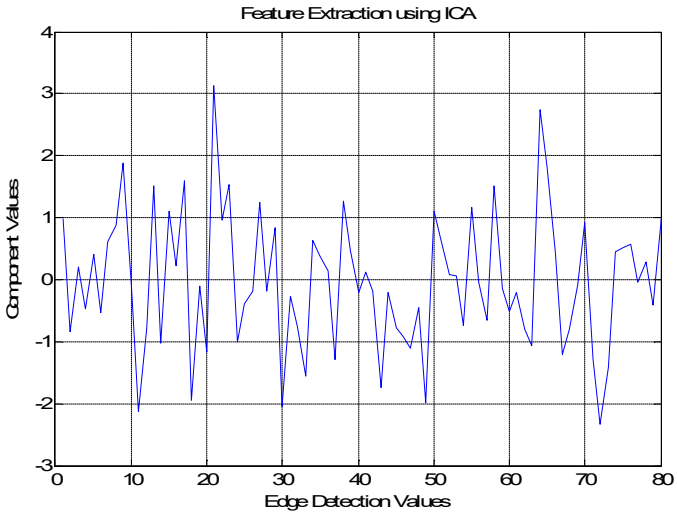


Fig 4.1: Feature Extraction using ICA

The above figure shows that the extracted features and results with ICA algorithm. It extract the unique properties of the face image and component based feature extracted.

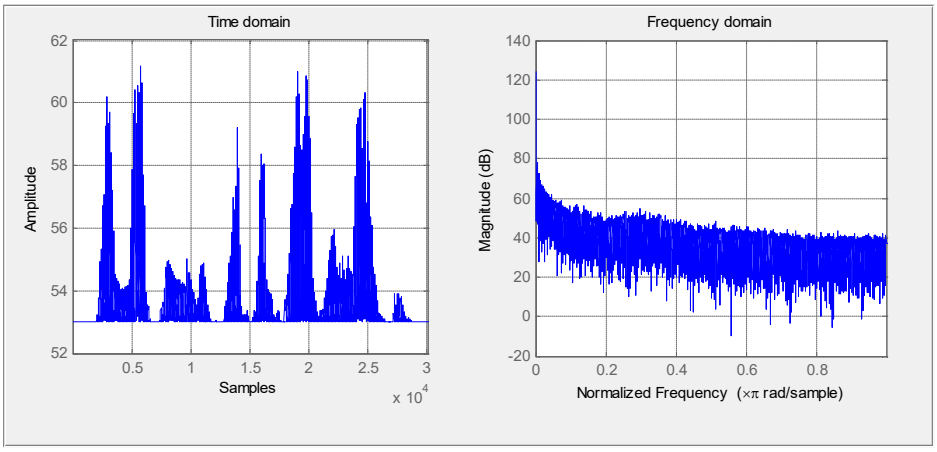


Fig 4.2: Time and Frequency Domain Spectrum Format

Above figure define the time domain and frequency domain in line format according to the amplitude and magnitude. A period area diagram demonstrates how a flag changes with time, while a recurrence space chart indicates the amount of flag exists in each recurrence band over a scope of frequencies.

Above figure also defines the time domain and frequency domain in spectrum format according to the obtained values of amplitude and magnitude. Recurrence is only the quantity of times every occasion has happened during the time of perception. Recurrence space investigation is much basic as you can make sense of the key focuses in the aggregate interim instead of putting your eye on each variety which happens in the time area examination.

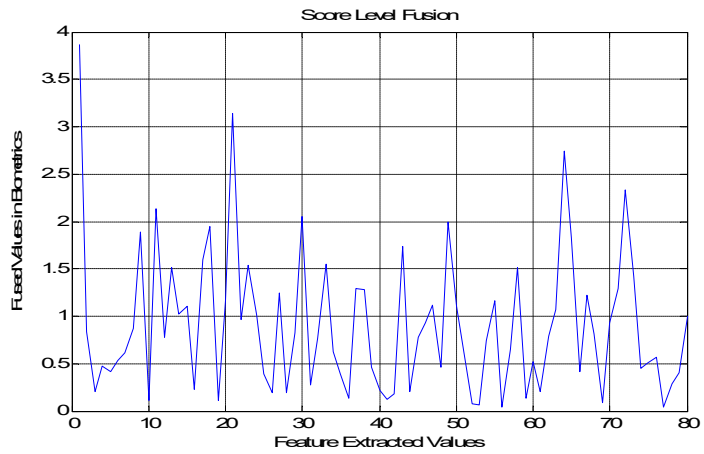


Fig 4.3: Score Level Fusion

The above figure shows that the Score level Fusion Apply for face and speech recognition using fused data.

b) CNN (Conventional Neural Network)

This architecture represents the training processor in the form of neural network. We defined the iteration for 1000, for illustrating the training performance, time and validation checks. This single-layer architecture used for classification purpose means first train the system through the algorithm and validate the system to identify how accurately work through performance parameters.

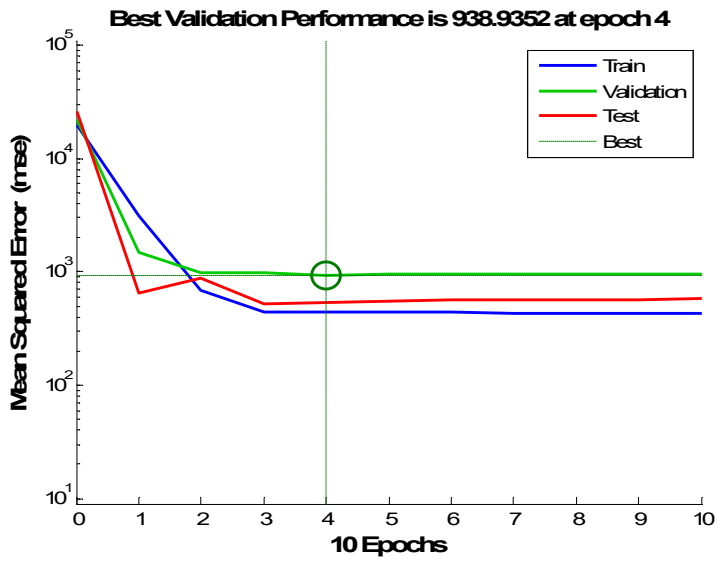


Fig 4.4: Best Validation Performance

The figure highlighted that the best execution esteem is 938.25 at 4 ages concerning Mean Square Mistake rate. In this figure blue line demonstrates the preparation, which we offer up to 3 and green line demonstrates the approval of the framework execution and the red line demonstrates the testing on the framework and demonstrates the best approval execution of the framework.

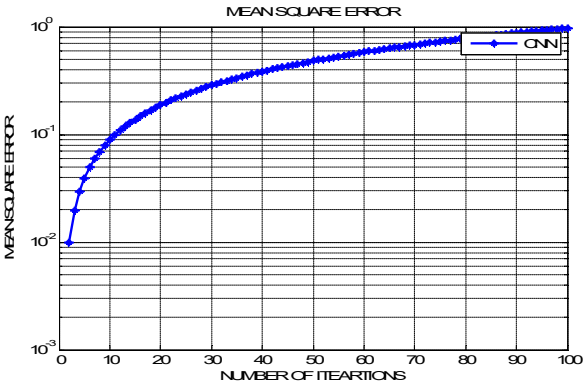


Fig 4.5: Mean Square Error Rate

The figure defines; the mean square error rate (MSE) or mean squared deviation (MSD), important parameter which reflected the average of error result. The average error value is found to be equal to 0.89.

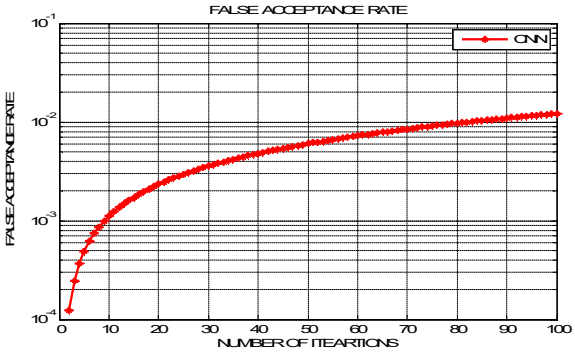


Fig 4.6: false acceptance Rate

The figure above gives the false acknowledgment rate i.e. 0.01889. The False Acknowledgment rate (FAR) is the likelihood that the framework erroneously approves a non-approved individual, due to mistakenly coordinating the biometric contribution with a layout.

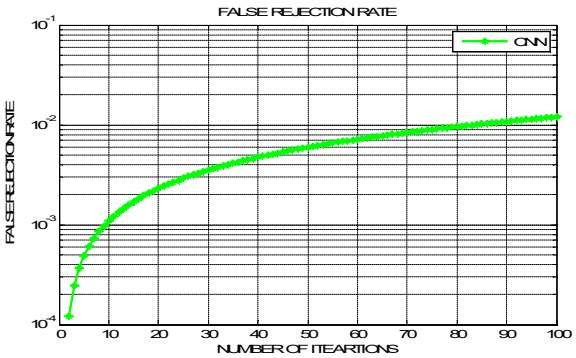


Fig 4.7: False Rejection rate

Figure above shows, the false rejection rate (FAR), means negative data collected using CNN for classification and gives its accuracy value. The false rejection rate (FAR) computed value is found to be 0.0081.

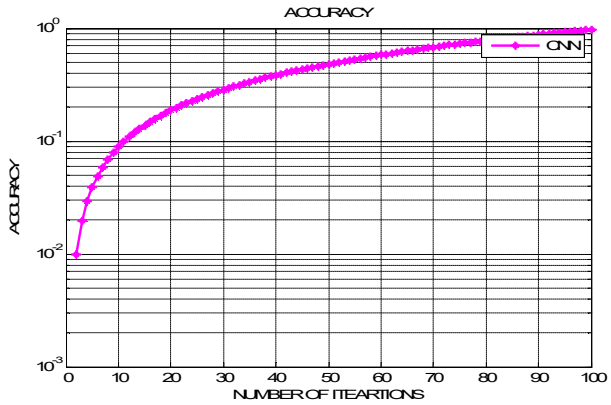


Fig 4.10 Accuracy

The above figure gives the obtained accuracy throughout of the whole system. We identified that the achieved accuracy value is approximately equal to 99%.

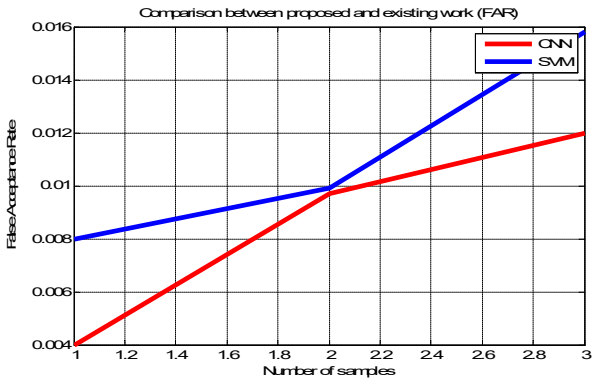


Fig 4.8: Comparison of FAR with proposed and existing Work

The False Acknowledgment rate (FAR) is the likelihood that the framework mistakenly approves a non-approved individual, due to erroneously coordinating the biometric contribution with a pre-defined layout. The false acceptance rate identified value for the proposed acceptable error is 0.01889 and existing acceptance error is 0.98.

Fig 4.9: False Rejection rate

Figure shows, comparison of the false rejection rate (FAR) means negative data collect using Feed forward neural network (FFNN) for classification and feature identifies the scale invariant feature transform. The false rejection rate (FAR) calculates the proposed value is 0.0081 and existing value is 0.0046.

V. CONCLUSION

We have presented a new user biometric authentication system based on a mutual attainment of facial and language or voice with highly accurate rate, true positive and rejection rate. Later FAR, FRR and exactness have been assessed in which PCA performance is found to be satisfactory i.e. For ICA and CNN Precision = 97%, FAR= 0.01831, FRR= 0.00815. From the obtained results, it has been inferred that autonomous segment examination and GTCC system functions admirably.

VI. REFERENCES

[1] Snelick, Robert, Umut Uludag, Alan Mink, Mike Indovina, and Anil Jain. "Large-scale evaluation of multimodal biometric authentication using state-of-the-art systems." IEEE Transactions on Pattern Analysis and Machine Intelligence 27, no. 3 (2005): 450-455.

[2] Wayman, James, Anil Jain, Davide Maltoni, and Dario Maio. An introduction to biometric authentication systems. Springer London, 2005.

[3] Tuyls, Pim, Anton HM Akkermans, Tom AM Kevenaar, Geert-Jan Schrijen, Asker M. Bazen, and Raimond NJ Veldhuis. "Practical biometric authentication with template protection." In International Conference on Audio-and Video-Based Biometric Person Authentication, pp. 436-446. Springer Berlin Heidelberg, 2005.

[4] Fierrez-Aguilar, Julian, Javier Ortega-Garcia, Joaquin Gonzalez-Rodriguez, and Josef Bigun. "Discriminative multimodal biometric authentication based on quality measures." Pattern Recognition 38, no. 5 (2005): 777-779.

[5] Deb, Kalyanmoy, AmritPratap, Sameer Agarwal, and T. A. M. T. Meyarivan. "A fast and elitist multiobjective genetic algorithm: NSGA-II." IEEE transactions on evolutionary computation 6, no. 2 (2002): 182-197.

[6] Snellick, R., U. Uludag, and A. Mink. "Large scale evaluation of multi-model biometric authentication using state-of-the-art system." IEEE Trans on Pattern Analysis and Machine Intelligence 27, no. 3 (2005): 450-455.

[7] Lee, Y., Lee, K., Jee, H. and Pan, S., Lee Yong J, Lee Kyung H, Jee Hyung K and Pan Sung B, 2005. Method for multi-model biometric identification and system thereof. U.S. Patent Application 11/245,586.

[8] Wang, Jingyan, Yongping Li, Ping Liang, Guohui Zhang, and Xinyu Ao. "An effective multi-biometrics solution for embedded device." In Systems, Man and Cybernetics, 2009. SMC 2009. IEEE International Conference on, pp. 917-922. IEEE, 2009.

[9] Jain, Anil K., Arun Ross, and Salil Prabhakar. "An introduction to biometric recognition." IEEE Transactions on circuits and systems for video technology 14, no. 1 (2004): 4-20.

[10] Ross, Arun, and Anil Jain. "Information fusion in biometrics." Pattern recognition letters 24, no. 13 (2003): 2115-2125.

[11] Mani, Seshadri, and David M. D'andrea. "Method and apparatus for multi-model hybrid comparison system." U.S. Patent 8,020,005, issued September 13, 2011.